MSFC-524

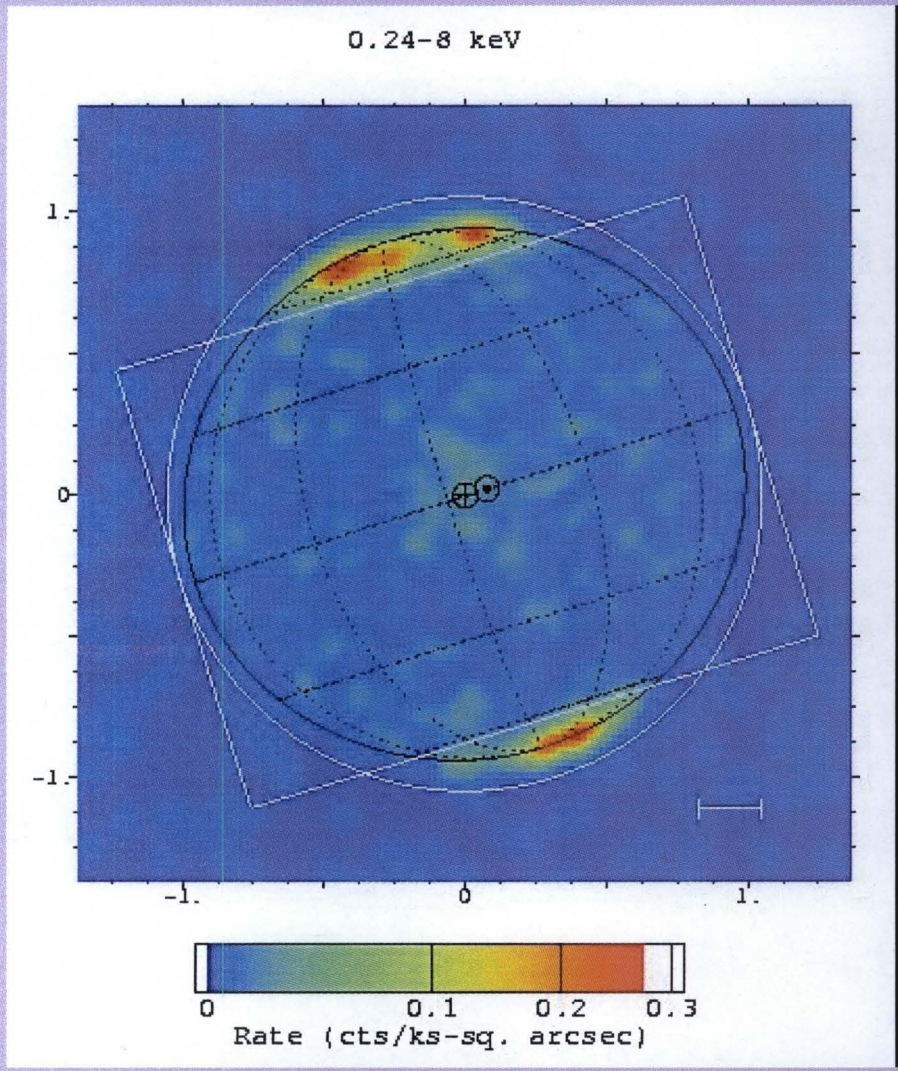
The Morphology of the X-ray Emission above 2 keV from Jupiter's Aurorae

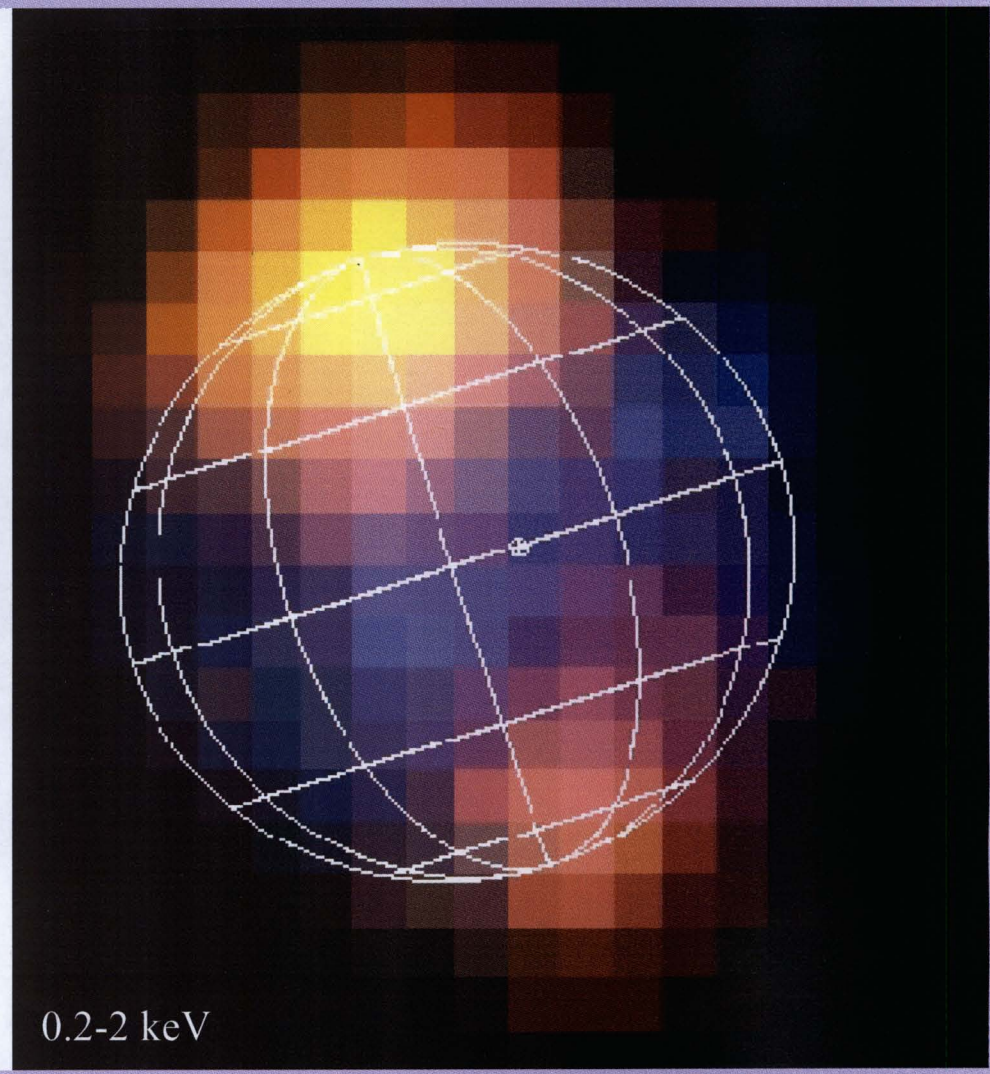
R. Elsner MSFC, G. Branduardi-Raymont MSSL, M. Galand ICL, D. Grodent, U. Liege, G. R. Gladstone & J. H. Waite SwRI, T. Cravens U. Kansas, P. Ford MIT

Abstract

The discovery in XMM-Newton X-ray data of X-ray emission above 2 keV from Jupiter's aurorae has led us to reexamine the Chandra ACIS-S observations taken in Feb 2003. Chandra's superior spatial resolution has revealed that the auroral X-rays with E > 2 keV are emitted from the periphery of the region emitting those with E < 1 keV. We are presently exploring the relationship of this morphology to that of the FUV emission from the main auroral oval and the polar cap. The low energy emission has previously been established as due to charge exchange between energetic precipitating ions of oxygen and either sulfur or carbon. It seems likely to us that the higher energy emission is due to precipitation of energetic electrons, possibly the same population of electrons responsible for the FUV emission. We discuss our analysis and interpretation.

Chandra and XMM-Newton Synergy

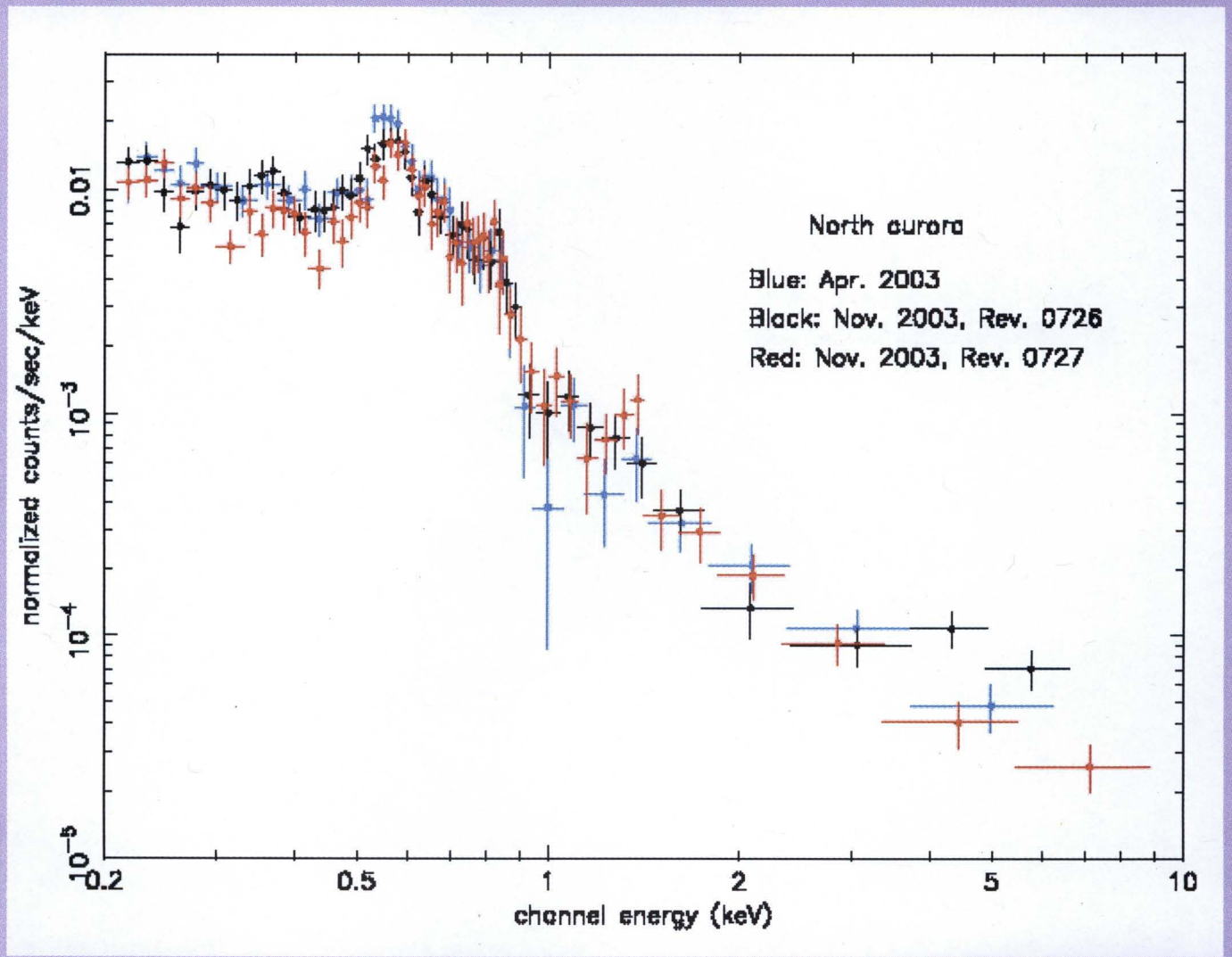




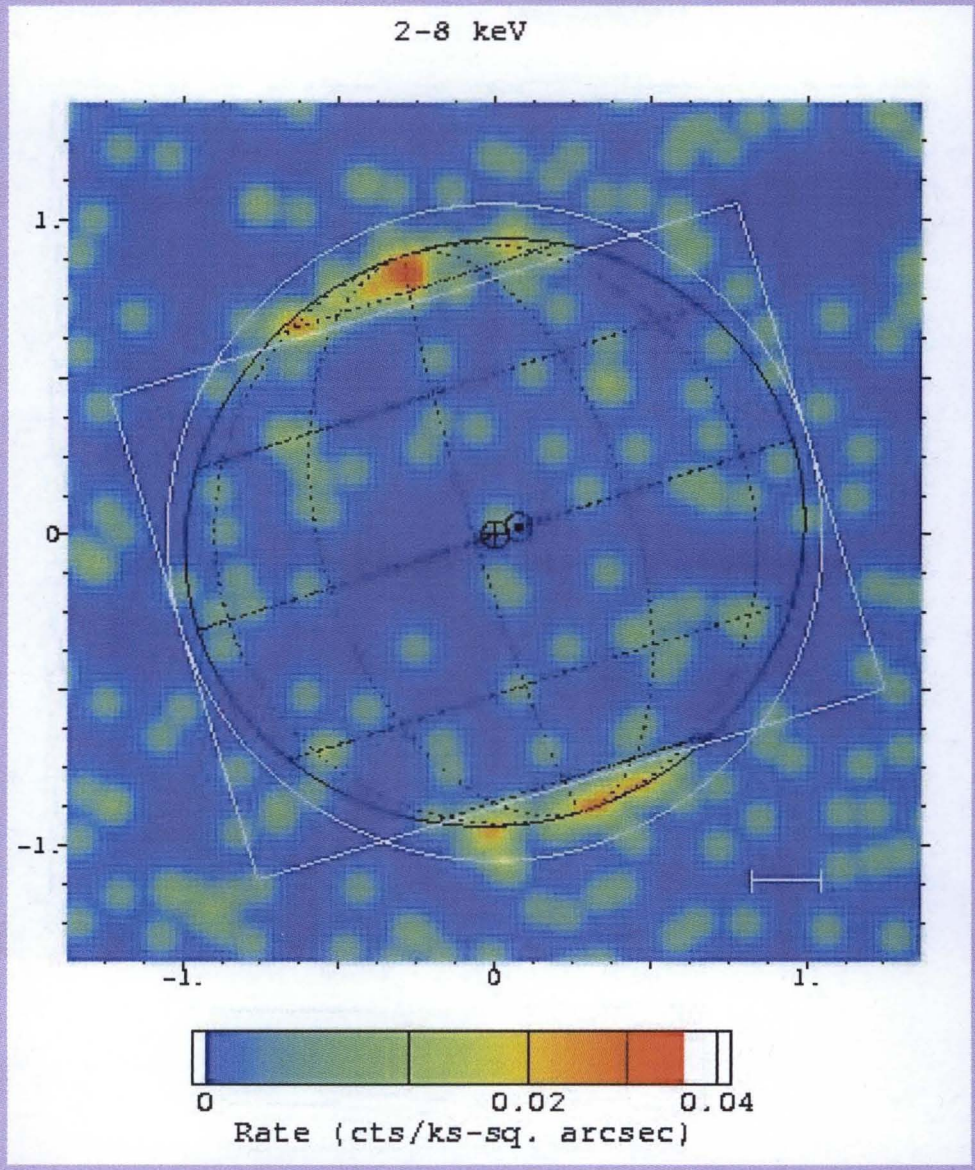
Chandra

XMM-Newton

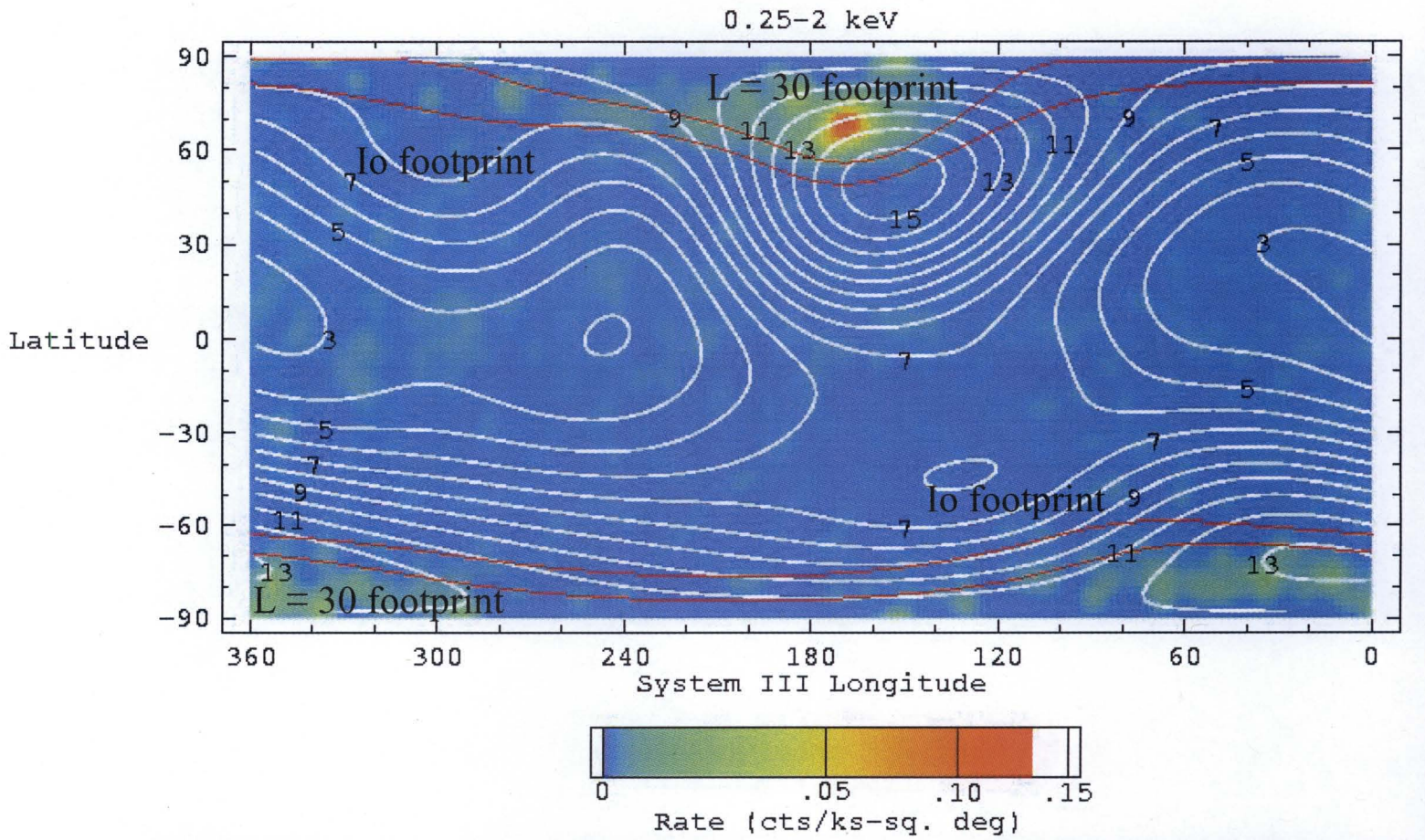
Northern Auroral Spectrum from XMM-Newton



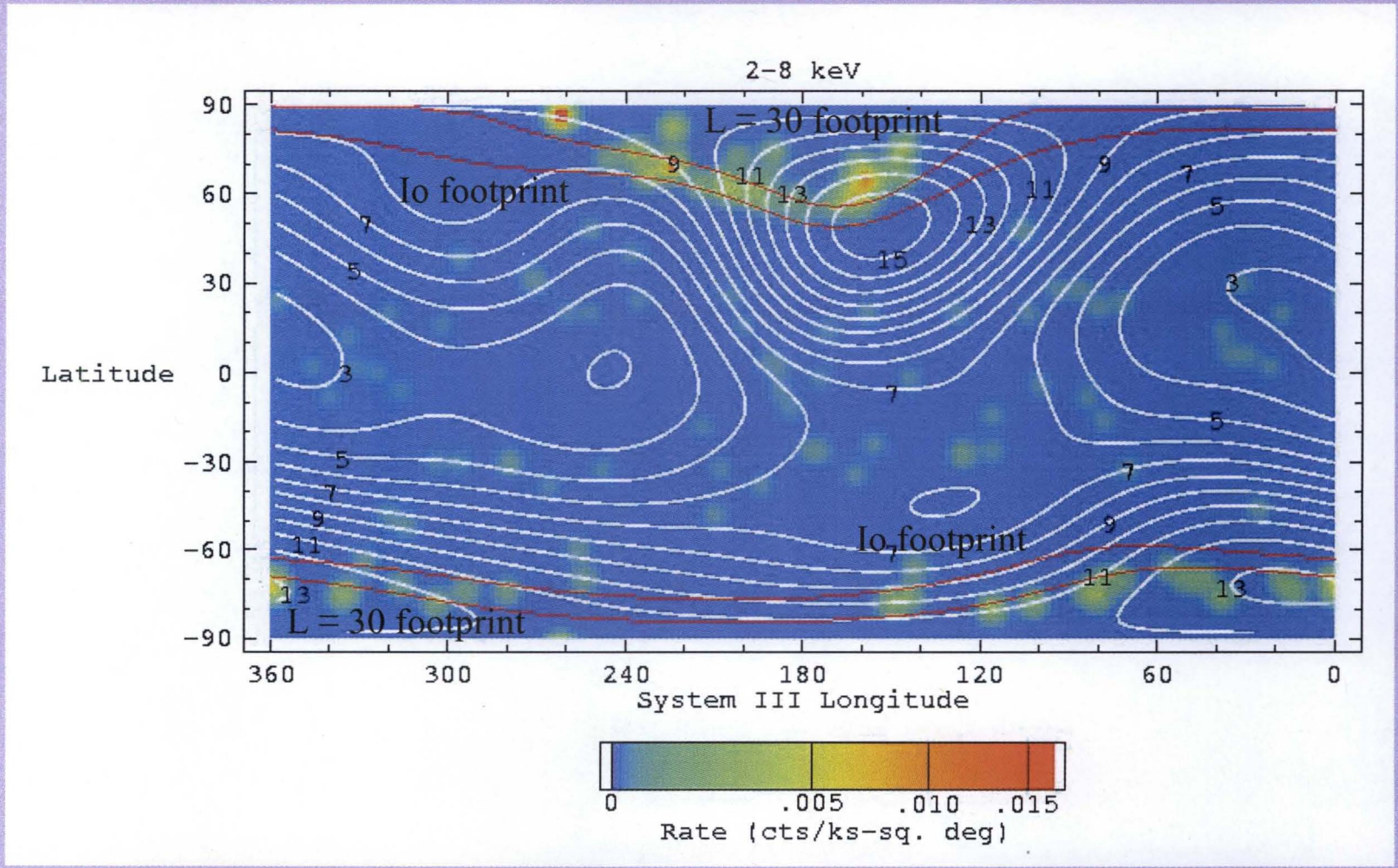
Jupiter's 2-8 keV Emission from Chandra



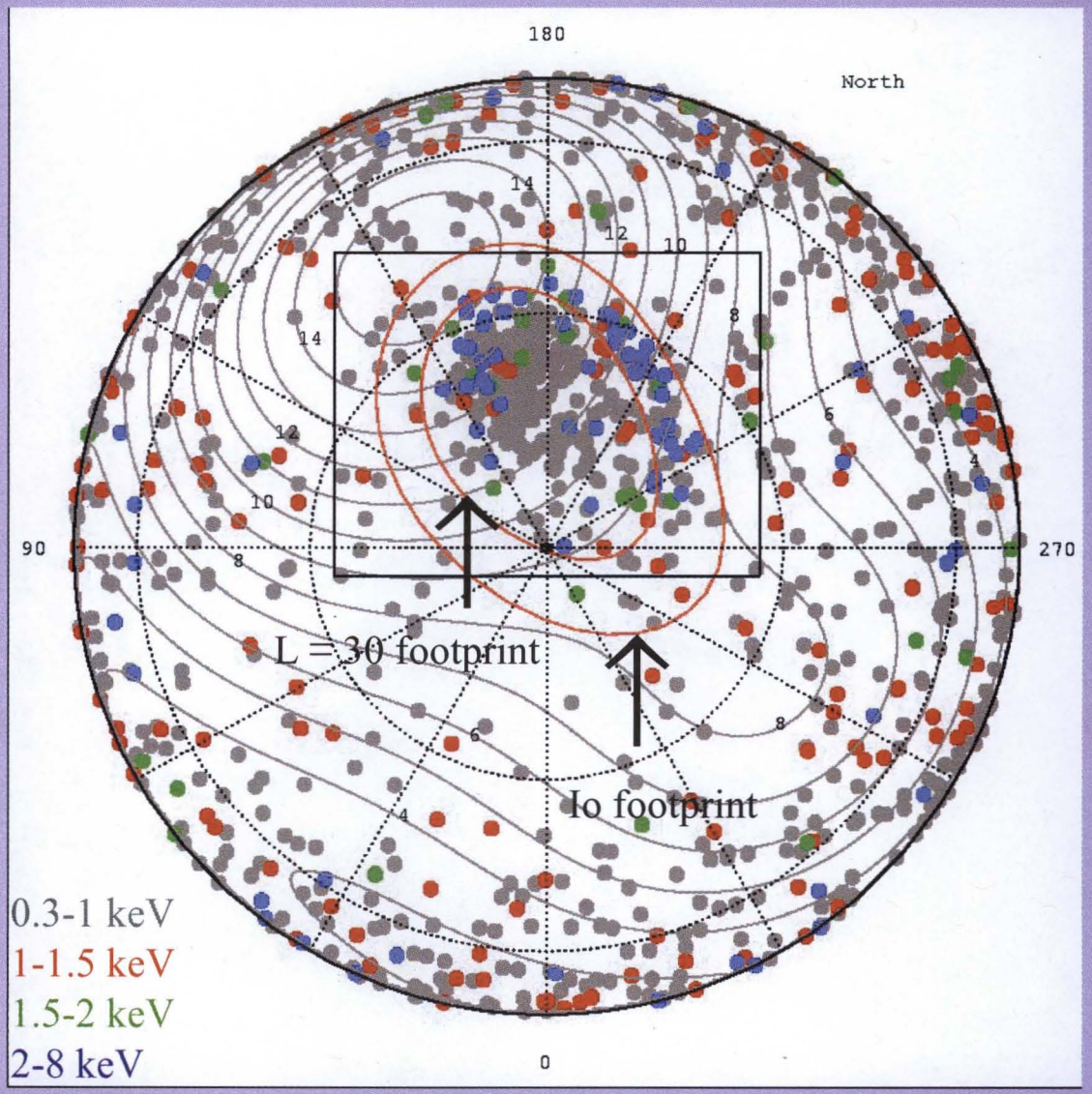
Distribution of Events in System III below 2 keV



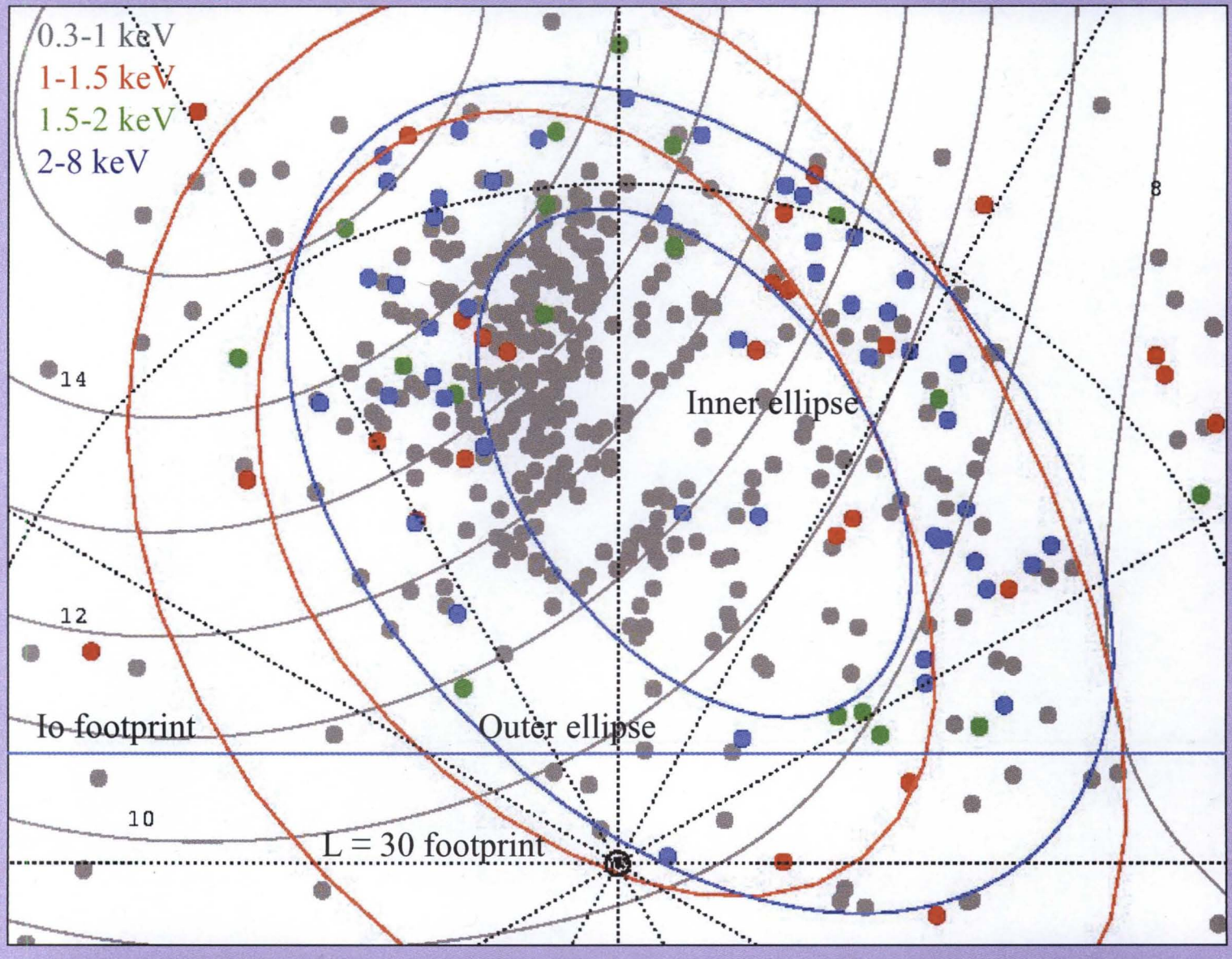
Distribution of Events in System III above 2 keV



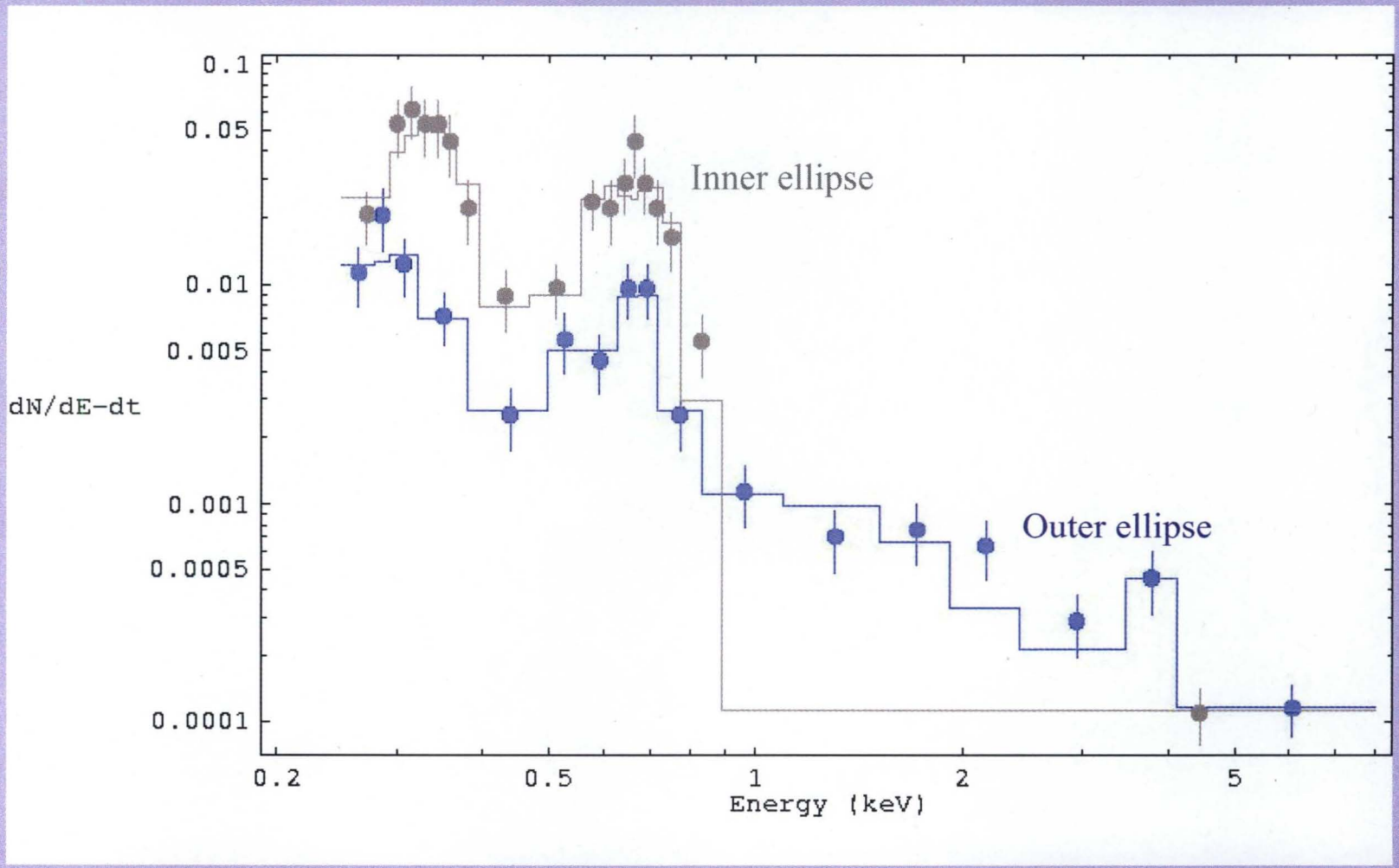
Distribution of Events in the Northern Hemisphere



Distribution of Events in the Northern Auroral Region



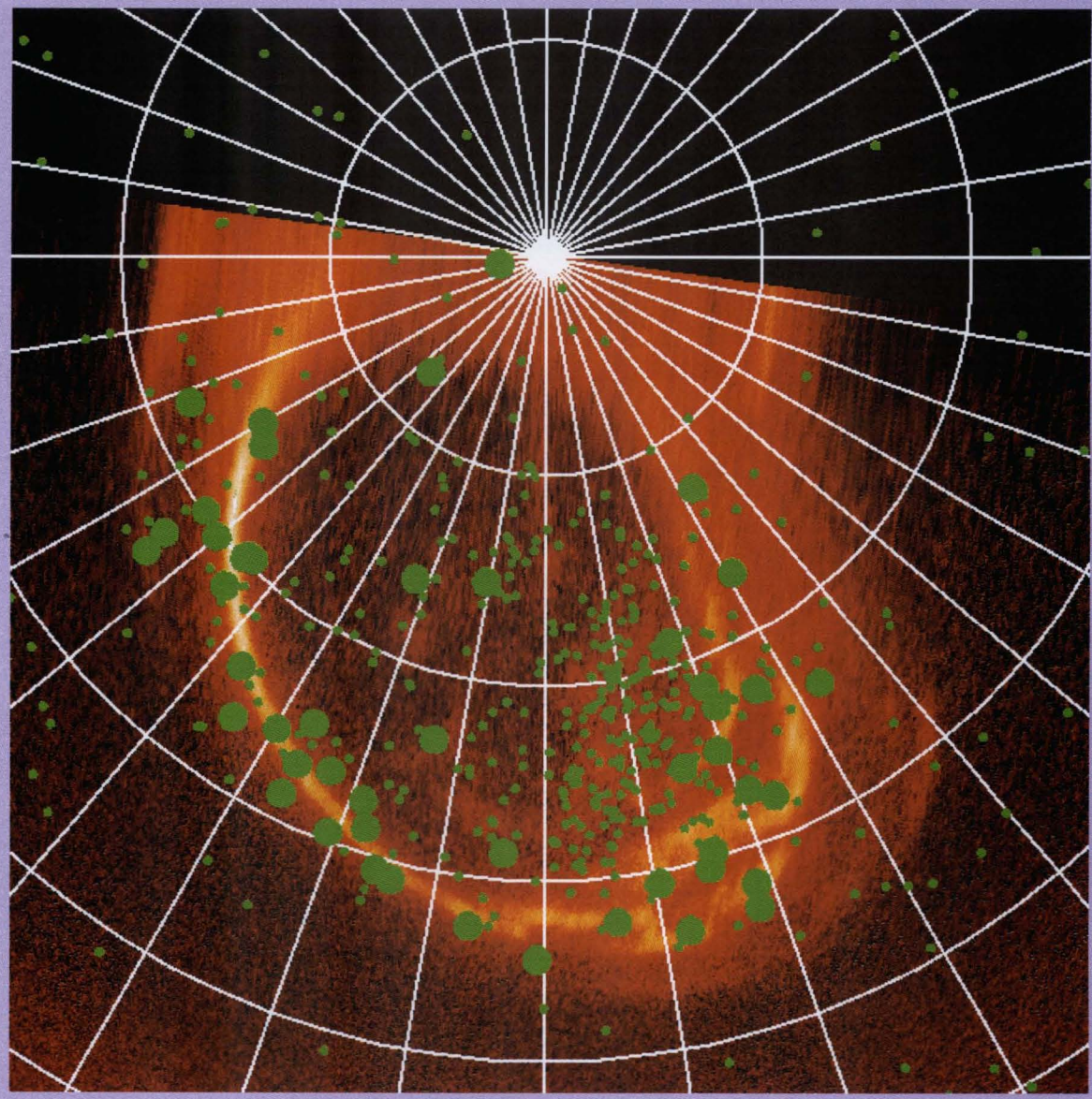
Northern Auroral Region X-ray Spectra



X-ray Events Overlaid on FUV Emission

Small green dots:
< 2 keV events

Large green dots:
> 2 keV events



180°

HST STIS FUV
image from
24 Feb 2003

Summary

The spatial distribution of X-rays from Jupiter's aurorae depends on energy.

During the Chandra/ACIS-S observations in Feb 2003, events in the 2–8 keV energy band, with a continuum spectrum consistent with electron bremsstrahlung, lie on the periphery of events in the 0.3–1 keV energy, with a line spectrum consistent with ionic charge exchange.

The events in the 2–8 keV energy band are largely co-located with bright FUV auroral regions (as simultaneously observed with HST/STIS), and the hard X-ray emission and the FUV emission may result from the same population of precipitating electrons.

We are presently analyzing new Chandra observations of Jupiter recently acquired in conjuction with the New Horizons flyby, and will be carrying out similar studies for those data.